PATENT
1155-0226P

IN THE U.S. PATENT AND TRADEMARK OFFICE

Applicant:	MITANI, Makoto et al.	Conf.:	Unknown
Int'l. Appl. No.:	PCT/JP/01/00522		
Appl. No.:	New	Group:	Unknown
Filed:	September 26, 2001	Examiner:	Unassigned
For:	OLEFIN POLYMER AND PROCESS FOR PREPARING THE SAME		

PRELIMINARY AMENDMENT

BOX PATENT APPLICATION
Assistant Commissioner for Patents
Washington, DC 20231

September 26, 2001

Sir:

The following Preliminary Amendments and Remarks are respectfully submitted in connection with the above-identified application.

AMENDMENTS

IN THE SPECIFICATION:

Please amend the specification as follows:

Before line 1, insert --This application is the national phase under 35 U.S.C. § 371 of PCT International Application No. PCT/JP01/00522 which has an International filing date of January 26, 2001, which designated the United States of America.--

IN THE CLAIMS:

Please amend the claims as follows:

15. (Amended) The olefin polymer as claimed in claim 11,

wherein a sequence of two or more continuous methylene groups is detected by means of ^{13}C-NMR, and a sequence of two consecutive methylene groups and a sequence of three or more consecutive methylene groups are both detected.

26. (Amended) The olefin polymer as claimed in claims 1, 7, 10, or 16, which has a functional group at the terminal of the main chain.

27. (Amended) A molded product comprising the olefin polymer of 1, 7, 10, or 16.

34. (Amended) A process for preparing an olefin polymer, comprising polymerizing an olefin of 2 to 20 carbon atoms in the presence of an olefin polymerization catalyst comprising the transition metal compound of claim 32, to prepare the olefin polymer.

35. (Amended) A process for preparing an olefin polymer, comprising polymerizing an olefin of 2 to 20 carbon atoms in the presence of an olefin polymerization catalyst comprising a transition metal compound to prepare a polymer and then bringing the polymer into contact with a functional group-containing compound to prepare an olefin polymer having a functional group at the terminal, said transition metal compound_being selected from the group consisting of

a transition metal compound which is represented by the following formula (I) and has properties that, in a β-agostic structure of a cationic complex wherein one of X in the formula (I) is replaced with a n-propyl group, said structure being measured by a density functional method, the distance between the heteroatom, which has no direct bond to the central metal M and is nearest to the central metal M, and hydrogen at the β-position is not more than 3.0 Å and the electrostatic energy is not more than 10kJ/mol,

$$L_mMX_n \qquad (I)$$

wherein M is a transition metal atom selected from Group 3 to Group 11 of the periodic table,

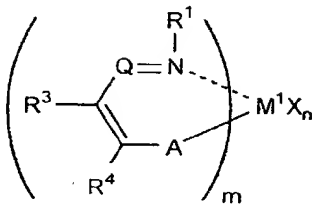
m is an integer of 1 to 5,

n is a number satisfying a valence of M,

L is a ligand coordinated to the central metal M and is a ligand having a heteroatom which has no direct bond to the central metal M, and

X is an oxygen atom, a hydrogen atom, a halogen atom, a hydrocarbon group, an oxygen-containing group, a sulfur-containing group, a nitrogen-containing group, a boron-containing group, an aluminum-containing group, a phosphorus-containing group, a halogen-containing group, a heterocyclic compound residue, a silicon-containing group, a germanium-containing group or a tin-containing group, and when n is 2 or greater, plural groups indicated by X my be the same or different, and plural groups indicated by X may be bonded to form a ring:

a transition metal compound which is represented by the following formula (II-a)



(II-a)

wherein M^1 is a transition metal atom selected from Group 3 to Group 11 of the periodic table,

m is an integer of 1 to 5,

Q is a nitrogen atom or a carbon atom having a substituent R^2,

A is an oxygen atom, a sulfur atom, a selenium atom or a nitrogen atom having a substituent R^5,

R^1 is an aromatic hydrocarbon group, an aliphatic hydrocarbon group or an alicyclic hydrocarbon group, selected from a phenyl group having, at least one position of the 2-position and the 6-position, when the position of the carbon atom bonded to nitrogen is the 1-position, one or more substituents selected from a halogen atom and a halogen-containing group, or a phenyl group having, at least one position of the 3-position, the 4-position and the 5-position, and least one substituent selected from a fluorine-containing group having one carbon atom and not more than two fluorine atoms, a fluorine-containing group having two or more carbon atoms, a chlorine atom, a bromine atom, an

iodine atom, a chlorine-containing group, a bromine-containing group and an iodine-containing group, an aromatic hydrocarbon group other than a phenyl group having at least one substituent selected from a halogen atom and a halogen-containing group, an aliphatic hydrocarbon group having at least one substituent selected from a halogen atom and a halogen-containing group, or an alicyclic hydrocarbon group having at least one substituent selected from a halogen atom and a halogen-containing group,

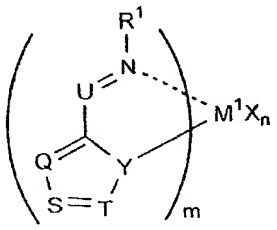
R^2 to R^5 may be the same or different and are each a hydrogen atom, a halogen atom, a hydrocarbon group, a hydrocarbon-substituted silyl group, an oxygen-containing group, a nitrogen-containing group, a sulfur-containing group, a boron-containing group, an aluminum-containing group, a phosphorus-containing group, a halogen-containing group, a heterocyclic compound residue, a silicon-containing group, a germanium-containing group, or a tin-containing group, two or more of R^2 to R^5 may be bonded to form a ring, and when m is 2 or greater, R^1s, R^2s, R^3s, R^4s, and R^5s may be the same or different, and one group of R^2 to R^5 contained in one ligand and one group of R^2 to R^5 contained in other ligands may be bonded,

n is a number satisfying a valence of M^1, and

X is an oxygen atom, a hydrogen atom, a halogen atom, a hydrocarbon group, an oxygen-containing group, a sulfur-containing group, a nitrogen-containing group, a boron-containing group, an aluminum-containing group, a phosphorus-containing group, a halogen-containing group, a heterocyclic compound

residue, a silicon-containing group, a germanium-containing group or a tin-containing group, and when n is 2 or greater, plural groups indicated by X may be the same or different, and plural groups indicated by X may be bonded to form a ring;

a transition metal compound which is represented by the following formula (II-b)



(II-b)

wherein M^1 is a transition metal atom selected from Group 3 to Group 11 of the periodic table,

m is an integer of 1 to 5,

Y is a nitrogen atom or a phosphorus atom,

U is a carbon atom having a substituent R^6, a nitrogen atom or a phosphorus atom,

Q is a carbon atom having a substituent R^7, a nitrogen atom or a phosphorus atom,

S is a carbon atom having a substituent R^8, a nitrogen atom or a phosphorus atom,

T is a carbon atom having a substituent R^9, a nitrogen atom or a phosphorous atom,

R^1 is an aromatic hydrocarbon group, an aliphatic

hydrocarbon group or an alicyclic hydrocarbon group, selected from a phenyl group having, at least one position of the 2-position and the 6-position, when the position of the carbon atom bonded to nitrogen is the 1-position, one or more substituents selected from a halogen atom and a halogen-containing group, or a phenyl group having, at least one position of the 3-position, the 4-position and the 5-position, at least one substituent selected from a fluorine-containing group having one carbon atom and not more than two fluorine atoms, a fluorine-containing group having two or more carbon atoms, a chlorine atom, a bromine atom, an iodine atom, a chlorine-containing group, a bromine-containing group and an iodine-containing group, an aromatic hydrocarbon group other than a phenyl group having at least one substituent selected from a halogen atom and a halogen-containing group, an aliphatic hydrocarbon group having at least one substituent selected from a halogen atom and a halogen-containing group, or an alicyclic hydrocarbon group having at least one substituent selected from a halogen atom and a halogen-containing group,

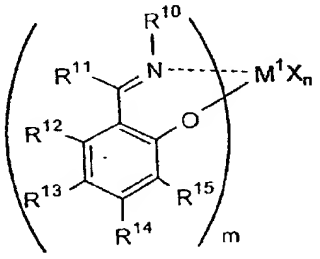
R^6 to R^9 may be the same or different and are each a hydrogen atom, a halogen atom, a hydrocarbon group, a hydrocarbon-substituted silyl group, an oxygen-containing group, a nitrogen-containing group, a sulfur-containing group, a boron-containing group, an aluminum-containing group, a phosphorus-containing group, a halogen-containing group, a heterocyclic compound residue, a silicon-containing group, a germanium-containing group or a tin-containing group, two or more of R^6 to

R^9 may be bonded to form a ring, and when m is 2 or greater, R^1s, R^6s, R^7, R^8s and R^9s may be the same or different, and one group of R^6 to R^9 contained in one ligand and one group of R^6 to R^9 contained in other ligands may be bonded,

n is a number satisfying a valence of M^1, and

X is an oxygen atom a hydrogen atom, a halogen atom, a hydrocarbon group, an oxygen-containing group, a sulfur-containing group, a nitrogen-containing group, a boron-containing group, an aluminum-containing group, a phosphorus-containing group, a halogen-containing group, a heterocyclic compound residue, a silicon-containing group, a germanium-containing group or a tin-containing group, and when n is 2 or greater, plural groups indicated by X may be the same or different, and plural groups indicated by X may be bonded to form a ring; and

a transition metal compound which is represented by the following formula (III)



(III)

wherein M^1 is a transition metal atom selected from Group 4 to Group 5 of the periodic table,

m is 1 or 2,

R^{10} is an aromatic hydrocarbon group, an aliphatic hydrocarbon group or an alicyclic hydrocarbon group, when R^{10} is a phenyl group and the position of the carbon atom bonded to nitrogen is the 1-position, this phenyl group has, at least one position of the 2-position and the 6-position, one or more substituents selected from a heteroatom and a heteroatom-containing group, or has, at least one position of the 3-position, the 4-position and the 5-position, at least one substituent selected from a heteroatom other than a fluorine atom, a fluorine-containing group having one carbon atom and not more than two fluorine atoms, a fluorine-containing group having two or more carbon atoms, and a group containing a heteroatom other than a fluorine atom, and when R^{10} is an aromatic hydrocarbon group other than a phenyl group, an aliphatic hydrocarbon group or an alicyclic group, this group has at least one substituent selected from a heteroatom and a heteroatom-containing group,

R^{11} to R^{14} may be the same or different and are each a hydrogen atom, a halogen atom, a halogen-containing group, a hydrocarbon group, a hydrocarbon-substituted silyl group, an oxygen-containing group, a nitrogen-containing group or a sulfur-containing group,

R^{15} is a halogen atom, a halogen-containing group, a hydrocarbon group or a hydrocarbon-substituted silyl group,

n is a number satisfying a valence of M, and

X is an oxygen atom, a hydrogen atom, a halogen atom, a

hydrocarbon group, an oxygen-containing group, a sulfur-containing group, a nitrogen-containing group, a boron-containing group, an aluminum-containing group, a phosphorus-containing group, a halogen-containing group, a heterocyclic compound residue, a silicon-containing group, a germanium-containing group or a tin-containing group, and when n is 2 or greater, plural groups indicated by X may be the same or different, and plural groups indicated by X may be bonded to form a ring.

36. (Amended) A process for preparing an olefin polymer, comprising polymerizing at least two olefins which are selected from olefins of 2 to 20 carbon atoms and have different polymerization reactivities, in the presence of an olefin polymerization catalyst comprising a transition metal compound to prepare a tapered polymer containing a segment wherein composition of two or more monomers continuously changes, said transition metal compound being selected from the group consisting of

a transition metal compound which is represented by the following formula (I) and has properties that, in a β-agostic structure of a cationic complex wherein one of X in the formula (I) is replaced with a n-propyl group, said structure being measured by a density functional method, the distance between the heteroatom, which has no direct bond to the central metal M and is nearest to the central metal M, and hydrogen at the β-position is not more than 3.0 Å and the electrostatic energy is not more

than 10kJ/mol,

$$L_mMX_n \qquad (I)$$

wherein M is a transition metal atom selected from Group 3 to Group 11 of the periodic table,

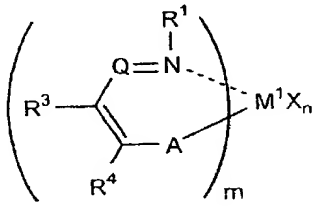
m is an integer of 1 to 5,

n is a number satisfying a valence of M,

L is a ligand coordinated to the central metal M and is a ligand having a heteroatom which has no direct bond to the central metal M, and

X is an oxygen atom, a hydrogen atom, a halogen atom, a hydrocarbon group, an oxygen-containing group, a sulfur-containing group, a nitrogen-containing group, a boron-containing group, an aluminum-containing group, a phosphorus-containing group, a halogen-containing group, a heterocyclic compound residue, a silicon-containing group, a germanium-containing group or a tin-containing group, and when n is 2 or greater, plural groups indicated by X my be the same or different, and plural groups indicated by X may be bonded to form a ring:

a transition metal compound which is represented by the following formula (II-a)



(II-a)

wherein M^1 is a transition metal atom selected from Group 3 to Group 11 of the periodic table,

m is an integer of 1 to 5,

Q is a nitrogen atom or a carbon atom having a substituent R^2,

A is an oxygen atom, a sulfur atom, a selenium atom or a nitrogen atom having a substituent R^5,

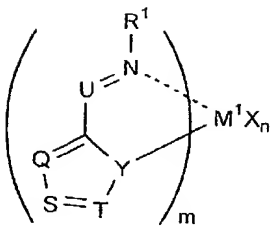
R^1 is an aromatic hydrocarbon group, an aliphatic hydrocarbon group or an alicyclic hydrocarbon group, selected from a phenyl group having, at least one position of the 2-position and the 6-position, when the position of the carbon atom bonded to nitrogen is the 1-position, one or more substituents selected from a halogen atom and a halogen-containing group, or a phenyl group having, at least one position of the 3-position, the 4-position and the 5-position, and least one substituent selected from a fluorine-containing group having one carbon atom and not more than two fluorine atoms, a fluorine-containing group having two or more carbon atoms, a chlorine atom, a bromine atom, an iodine atom, a chlorine-containing group, a bromine-containing group and an iodine-containing group, an aromatic hydrocarbon group other than a phenyl group having at least one substituent selected from a halogen atom and a halogen-containing group, an aliphatic hydrocarbon group having at least one substituent selected from a halogen atom and a halogen-containing group, or an alicyclic hydrocarbon group having at least one substituent selected from a halogen atom and a halogen-containing group,

R^2 to R^5 may be the same or different and are each a hydrogen atom, a halogen atom, a hydrocarbon group, a hydrocarbon-substituted silyl group, an oxygen-containing group, a nitrogen-containing group, a sulfur-containing group, a boron-containing group, an aluminum-containing group, a phosphorus-containing group, a halogen-containing group, a heterocyclic compound residue, a silicon-containing group, a germanium-containing group, or a tin-containing group, two or more of R^2 to R^5 may be bonded to form a ring, and when m is 2 or greater, R^1s, R^2s, R^3s, R^4s, and R^5s may be the same or different, and one group of R^2 to R^5 contained in one ligand and one group of R^2 to R^5 contained in other ligands may be bonded,

n is a number satisfying a valence of M^1, and

X is an oxygen atom, a hydrogen atom, a halogen atom, a hydrocarbon group, an oxygen-containing group, a sulfur-containing group, a nitrogen-containing group, a boron-containing group, an aluminum-containing group, a phosphorus-containing group, a halogen-containing group, a heterocyclic compound residue, a silicon-containing group, a germanium-containing group or a tin-containing group, and when n is 2 or greater, plural groups indicated by X may be the same or different, and plural groups indicated by X may be bonded to form a ring;

a transition metal compound which is represented by the following formula (II-b)



(II-b)

wherein M^1 is a transition metal atom selected from Group 3 to Group 11 of the periodic table,

m is an integer of 1 to 5,

Y is a nitrogen atom or a phosphorus atom,

U is a carbon atom having a substituent R^6, a nitrogen atom or a phosphorus atom,

Q is a carbon atom having a substituent R^7, a nitrogen atom or a phosphorus atom,

S is a carbon atom having a substituent R^8, a nitrogen atom or a phosphorus atom,

T is a carbon atom having a substituent R^9, a nitrogen atom or a phosphorous atom,

R^1 is an aromatic hydrocarbon group, an aliphatic hydrocarbon group or an alicyclic hydrocarbon group, selected from a phenyl group having, at least one position of the 2-position and the 6-position, when the position of the carbon atom bonded to nitrogen is the 1-position, one or more substituents selected from a halogen atom and a halogen-containing group, or a phenyl group having, at least one position of the 3-position, the

4-position and the 5-position, at least one substituent selected from a fluorine-containing group having one carbon atom and not more than two fluorine atoms, a fluorine-containing group having two or more carbon atoms, a chlorine atom, a bromine atom, an iodine atom, a chlorine-containing group, a bromine-containing group and an iodine-containing group, an aromatic hydrocarbon group other than a phenyl group having at least one substituent selected from a halogen atom and a halogen-containing group, an aliphatic hydrocarbon group having at least one substituent selected from a halogen atom and a halogen-containing group, or an alicyclic hydrocarbon group having at least one substituent selected from a halogen atom and a halogen-containing group,

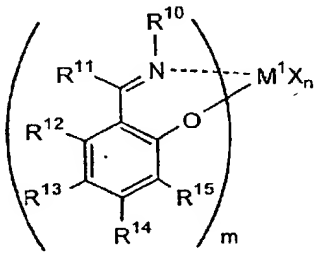
R^6 to R^9 may be the same or different and are each a hydrogen atom, a halogen atom, a hydrocarbon group, a hydrocarbon-substituted silyl group, an oxygen-containing group, a nitrogen-containing group, a sulfur-containing group, a boron-containing group, an aluminum-containing group, a phosphorus-containing group, a halogen-containing group, a heterocyclic compound residue, a silicon-containing group, a germanium-containing group or a tin-containing group, two or more of R^6 to R^9 may be bonded to form a ring, and when m is 2 or greater, R^1s, R^6s, R^7, R^8s and R^9s may be the same or different, and one group of R^6 to R^9 contained in one ligand and one group of R^6 to R^9 contained in other ligands may be bonded,

n is a number satisfying a valence of M^1, and

X is an oxygen atom a hydrogen atom, a halogen atom, a

hydrocarbon group, an oxygen-containing group, a sulfur-containing group, a nitrogen-containing group, a boron-containing group, an aluminum-containing group, a phosphorus-containing group, a halogen-containing group, a heterocyclic compound residue, a silicon-containing group, a germanium-containing group or a tin-containing group, and when n is 2 or greater, plural groups indicated by X may be the same or different, and plural groups indicated by X may be bonded to form a ring; and

a transition metal compound which is represented by the following formula (III)



(III)

wherein M^1 is a transition metal atom selected from Group 4 to Group 5 of the periodic table,

m is 1 or 2,

R^{10} is an aromatic hydrocarbon group, an aliphatic hydrocarbon group or an alicyclic hydrocarbon group, when R^{10} is a phenyl group and the position of the carbon atom bonded to nitrogen is the 1-position, this phenyl group has, at least one position of the 2-position and the 6-position, one or more substituents selected from a heteroatom and a heteroatom-

containing group, or has, at least one position of the 3-position, the 4-position and the 5-position, at least one substituent selected from a heteroatom other than a fluorine atom, a fluorine-containing group having one carbon atom and not more than two fluorine atoms, a fluorine-containing group having two or more carbon atoms, and a group containing a heteroatom other than a fluorine atom, and when R^{10} is an aromatic hydrocarbon group other than a phenyl group, an aliphatic hydrocarbon group or an alicyclic group, this group has at least one substituent selected from a heteroatom and a heteroatom-containing group,

R^{11} to R^{14} may be the same or different and are each a hydrogen atom, a halogen atom, a halogen-containing group, a hydrocarbon group, a hydrocarbon-substituted silyl group, an oxygen-containing group, a nitrogen-containing group or a sulfur-containing group,

R^{15} is a halogen atom, a halogen-containing group, a hydrocarbon group or a hydrocarbon-substituted silyl group,

n is a number satisfying a valence of M, and

X is an oxygen atom, a hydrogen atom, a halogen atom, a hydrocarbon group, an oxygen-containing group, a sulfur-containing group, a nitrogen-containing group, a boron-containing group, an aluminum-containing group, a phosphorus-containing group, a halogen-containing group, a heterocyclic compound residue, a silicon-containing group, a germanium-containing group or a tin-containing group, and when n is 2 or greater, plural

groups indicated by X may be the same or different, and plural groups indicated by X may be bonded to form a ring.

37. (Amended) A process for preparing an olefin polymer, comprising conducting the following step (1), the following step (2), and optionally, the following step (3) of an arbitrary number of times, to prepare a block copolymer having structure wherein plural polymer blocks are bonded;

(1) a step of polymerizing at least one olefin selected from olefins of 2 to 20 carbon atoms in the presence of an olefin polymerization catalyst comprising a transition metal compound to prepare a polymer block, said transition metal compound being selected from the group consisting of

a transition metal compound which is represented by the following formula (I) and has properties that, in a β-agostic structure of a cationic complex wherein one of X in the formula (I) is replaced with a n-propyl group, said structure being measured by a density functional method, the distance between the heteroatom, which has no direct bond to the central metal M and is nearest to the central metal M, and hydrogen at the β-position is not more than 3.0 Å and the electrostatic energy is not more than 10kJ/mol,

$$L_mMX_n \qquad (I)$$

wherein M is a transition metal atom selected from Group 3 to Group 11 of the periodic table,

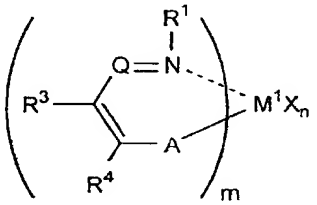
m is an integer of 1 to 5,

n is a number satisfying a valence of M,

L is a ligand coordinated to the central metal M and is a ligand having a heteroatom which has no direct bond to the central metal M, and

X is an oxygen atom, a hydrogen atom, a halogen atom, a hydrocarbon group, an oxygen-containing group, a sulfur-containing group, a nitrogen-containing group, a boron-containing group, an aluminum-containing group, a phosphorus-containing group, a halogen-containing group, a heterocyclic compound residue, a silicon-containing group, a germanium-containing group or a tin-containing group, and when n is 2 or greater, plural groups indicated by X my be the same or different, and plural groups indicated by X may be bonded to form a ring:

a transition metal compound which is represented by the following formula (II-a)



(II-a)

wherein M^1 is a transition metal atom selected from Group 3 to Group 11 of the periodic table,

m is an integer of 1 to 5,

Q is a nitrogen atom or a carbon atom having a substituent R^2,

A is an oxygen atom, a sulfur atom, a selenium atom or a nitrogen atom having a substituent R^5,

R^1 is an aromatic hydrocarbon group, an aliphatic hydrocarbon group or an alicyclic hydrocarbon group, selected from a phenyl group having, at least one position of the 2-position and the 6-position, when the position of the carbon atom bonded to nitrogen is the 1-position, one or more substituents selected from a halogen atom and a halogen-containing group, or a phenyl group having, at least one position of the 3-position, the 4-position and the 5-position, and least one substituent selected from a fluorine-containing group having one carbon atom and not more than two fluorine atoms, a fluorine-containing group having two or more carbon atoms, a chlorine atom, a bromine atom, an iodine atom, a chlorine-containing group, a bromine-containing group and an iodine-containing group, an aromatic hydrocarbon group other than a phenyl group having at least one substituent selected from a halogen atom and a halogen-containing group, an aliphatic hydrocarbon group having at least one substituent selected from a halogen atom and a halogen-containing group, or an alicyclic hydrocarbon group having at least one substituent selected from a halogen atom and a halogen-containing group,

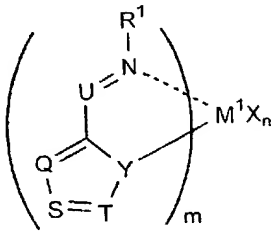
R^2 to R^5 may be the same or different and are each a hydrogen atom, a halogen atom, a hydrocarbon group, a hydrocarbon-substituted silyl group, an oxygen-containing group, a nitrogen-containing group, a sulfur-containing group, a boron-containing group, an aluminum-containing group, a phosphorus-

containing group, a halogen-containing group, a heterocyclic compound residue, a silicon-containing group, a germanium-containing group, or a tin-containing group, two or more of R^2 to R^5 may be bonded to form a ring, and when m is 2 or greater, R^1s, R^2s, R^3s, R^4s, and R^5s may be the same or different, and one group of R^2 to R^5 contained in one ligand and one group of R^2 to R^5 contained in other ligands may be bonded,

n is a number satisfying a valence of M^1, and

X is an oxygen atom, a hydrogen atom, a halogen atom, a hydrocarbon group, an oxygen-containing group, a sulfur-containing group, a nitrogen-containing group, a boron-containing group, an aluminum-containing group, a phosphorus-containing group, a halogen-containing group, a heterocyclic compound residue, a silicon-containing group, a germanium-containing group or a tin-containing group, and when n is 2 or greater, plural groups indicated by X may be the same or different, and plural groups indicated by X may be bonded to form a ring;

a transition metal compound which is represented by the following formula (II-b)



(II-b)

wherein M^1 is a transition metal atom selected from Group 3 to Group 11 of the periodic table,

m is an integer of 1 to 5,

Y is a nitrogen atom or a phosphorus atom,

U is a carbon atom having a substituent R^6, a nitrogen atom or a phosphorus atom,

Q is a carbon atom having a substituent R^7, a nitrogen atom or a phosphorus atom,

S is a carbon atom having a substituent R^8, a nitrogen atom or a phosphorus atom,

T is a carbon atom having a substituent R^9, a nitrogen atom or a phosphorous atom,

R^1 is an aromatic hydrocarbon group, an aliphatic hydrocarbon group or an alicyclic hydrocarbon group, selected from a phenyl group having, at least one position of the 2-position and the 6-position, when the position of the carbon atom bonded to nitrogen is the 1-position, one or more substituents selected from a halogen atom and a halogen-containing group, or a phenyl group having, at least one position of the 3-position, the 4-position and the 5-position, at least one substituent selected from a fluorine-containing group having one carbon atom and not more than two fluorine atoms, a fluorine-containing group having two or more carbon atoms, a chlorine atom, a bromine atom, an iodine atom, a chlorine-containing group, a bromine-containing group and an iodine-containing group, an aromatic hydrocarbon group other than a phenyl group having at least one substituent

selected from a halogen atom and a halogen-containing group, an aliphatic hydrocarbon group having at least one substituent selected from a halogen atom and a halogen-containing group, or an alicyclic hydrocarbon group having at least one substituent selected from a halogen atom and a halogen-containing group,

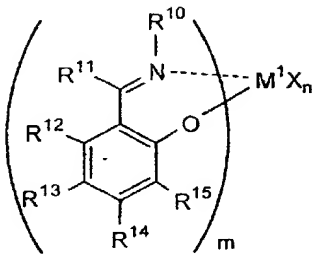
R^6 to R^9 may be the same or different and are each a hydrogen atom, a halogen atom, a hydrocarbon group, a hydrocarbon-substituted silyl group, an oxygen-containing group, a nitrogen-containing group, a sulfur-containing group, a boron-containing group, an aluminum-containing group, a phosphorus-containing group, a halogen-containing group, a heterocyclic compound residue, a silicon-containing group, a germanium-containing group or a tin-containing group, two or more of R^6 to R^9 may be bonded to form a ring, and when m is 2 or greater, R^1s, R^6s, R^7, R^8s and R^9s may be the same or different, and one group of R^6 to R^9 contained in one ligand and one group of R^6 to R^9 contained in other ligands may be bonded,

n is a number satisfying a valence of M^1, and

X is an oxygen atom a hydrogen atom, a halogen atom, a hydrocarbon group, an oxygen-containing group, a sulfur-containing group, a nitrogen-containing group, a boron-containing group, an aluminum-containing group, a phosphorus-containing group, a halogen-containing group, a heterocyclic compound residue, a silicon-containing group, a germanium-containing group or a tin-containing group, and when n is 2 or greater, plural groups indicated by X may be the same or different, and plural

groups indicated by X may be bonded to form a ring; and

a transition metal compound which is represented by the following formula (III)



(III)

wherein M^1 is a transition metal atom selected from Group 4 to Group 5 of the periodic table,

m is 1 or 2,

R^{10} is an aromatic hydrocarbon group, an aliphatic hydrocarbon group or an alicyclic hydrocarbon group, when R^{10} is a phenyl group and the position of the carbon atom bonded to nitrogen is the 1-position, this phenyl group has, at least one position of the 2-position and the 6-position, one or more substituents selected from a heteroatom and a heteroatom-containing group, or has, at least one position of the 3-position, the 4-position and the 5-position, at least one substituent selected from a heteroatom other than a fluorine atom, a fluorine-containing group having one carbon atom and not more than two fluorine atoms, a fluorine-containing group having two or more carbon atoms, and a group containing a heteroatom other than a fluorine atom, and when R^{10} is an aromatic

hydrocarbon group other than a phenyl group, an aliphatic hydrocarbon group or an alicyclic group, this group has at least one substituent selected from a heteroatom and a heteroatom-containing group,

R^{11} to R^{14} may be the same or different and are each a hydrogen atom, a halogen atom, a halogen-containing group, a hydrocarbon group, a hydrocarbon-substituted silyl group, an oxygen-containing group, a nitrogen-containing group or a sulfur-containing group,

R^{15} is a halogen atom, a halogen-containing group, a hydrocarbon group or a hydrocarbon-substituted silyl group,

n is a number satisfying a valence of M, and

X is an oxygen atom, a hydrogen atom, a halogen atom, a hydrocarbon group, an oxygen-containing group, a sulfur-containing group, a nitrogen-containing group, a boron-containing group, an aluminum-containing group, a phosphorus-containing group, a halogen-containing group, a heterocyclic compound residue, a silicon-containing group, a germanium-containing group or a tin-containing group, and when n is 2 or greater, plural groups indicated by X may be the same or different, and plural groups indicated by X may be bonded to form a ring,

(2) a step of polymerizing at least one olefin selected from olefins of 2 to 20 carbon atoms in the presence of the polymer block prepared in the step (1) to prepare a polymer block which is different from the polymer block prepared in the step (1), and

(3) a step of polymerizing at least one olefin selected from

olefins of 2 to 20 carbon atoms in the presence of the polymer block prepared in the step (1) and the polymer block prepared in the step (2) to prepare a polymer block which is different from the polymer blocks prepared in the previous step.

41. (Amended) The process for preparing an olefin polymer as claimed in claim 39, wherein the olefin polymerization catalyst is the catalyst comprising a transition metal compound selected from the group consisting of

a transition metal compound which is represented by the following formula (I) and has properties that, in a β-agostic structure of a cationic complex wherein one of X in the formula (I) is replaced with a n-propyl group, said structure being measured by a density functional method, the distance between the heteroatom, which has no direct bond to the central metal M and is nearest to the central metal M, and hydrogen at the β-position is not more than 3.0 Å and the electrostatic energy is not more than 10kJ/mol,

$$L_mMX_n \qquad (I)$$

wherein M is a transition metal atom selected from Group 3 to Group 11 of the periodic table,

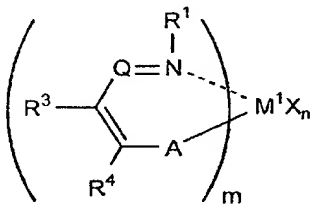
m is an integer of 1 to 5,

n is a number satisfying a valence of M,

L is a ligand coordinated to the central metal M and is a ligand having a heteroatom which has no direct bond to the central metal M, and

X is an oxygen atom, a hydrogen atom, a halogen atom, a hydrocarbon group, an oxygen-containing group, a sulfur-containing group, a nitrogen-containing group, a boron-containing group, an aluminum-containing group, a phosphorus-containing group, a halogen-containing group, a heterocyclic compound residue, a silicon-containing group, a germanium-containing group or a tin-containing group, and when n is 2 or greater, plural groups indicated by X my be the same or different, and plural groups indicated by X may be bonded to form a ring:

a transition metal compound which is represented by the following formula (II-a)



(II-a)

wherein M1 is a transition metal atom selected from Group 3 to Group 11 of the periodic table,

m is an integer of 1 to 5,

Q is a nitrogen atom or a carbon atom having a substituent R^2,

A is an oxygen atom, a sulfur atom, a selenium atom or a nitrogen atom having a substituent R^5,

R^1 is an aromatic hydrocarbon group, an aliphatic hydrocarbon group or an alicyclic hydrocarbon group, selected

from a phenyl group having, at least one position of the 2-position and the 6-position, when the position of the carbon atom bonded to nitrogen is the 1-position, one or more substituents selected from a halogen atom and a halogen-containing group, or a phenyl group having, at least one position of the 3-position, the 4-position and the 5-position, and least one substituent selected from a fluorine-containing group having one carbon atom and not more than two fluorine atoms, a fluorine-containing group having two or more carbon atoms, a chlorine atom, a bromine atom, an iodine atom, a chlorine-containing group, a bromine-containing group and an iodine-containing group, an aromatic hydrocarbon group other than a phenyl group having at least one substituent selected from a halogen atom and a halogen-containing group, an aliphatic hydrocarbon group having at least one substituent selected from a halogen atom and a halogen-containing group, or an alicyclic hydrocarbon group having at least one substituent selected from a halogen atom and a halogen-containing group,

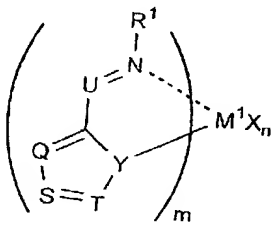
R^2 to R^5 may be the same or different and are each a hydrogen atom, a halogen atom, a hydrocarbon group, a hydrocarbon-substituted silyl group, an oxygen-containing group, a nitrogen-containing group, a sulfur-containing group, a boron-containing group, an aluminum-containing group, a phosphorus-containing group, a halogen-containing group, a heterocyclic compound residue, a silicon-containing group, a germanium-containing group, or a tin-containing group, two or more of R^2 to R^5 may be bonded to form a ring, and when m is 2 or greater, R^1s,

R^2s, R^3s, R^4s, and R^5s may be the same or different, and one group of R^2 to R^5 contained in one ligand and one group of R^2 to R^5 contained in other ligands may be bonded,

n is a number satisfying a valence of M^1, and

X is an oxygen atom, a hydrogen atom, a halogen atom, a hydrocarbon group, an oxygen-containing group, a sulfur-containing group, a nitrogen-containing group, a boron-containing group, an aluminum-containing group, a phosphorus-containing group, a halogen-containing group, a heterocyclic compound residue, a silicon-containing group, a germanium-containing group or a tin-containing group, and when n is 2 or greater, plural groups indicated by X may be the same or different, and plural groups indicated by X may be bonded to form a ring;

a transition metal compound which is represented by the following formula (II-b)



(II-b)

wherein M^1 is a transition metal atom selected from Group 3 to Group 11 of the periodic table,

m is an integer of 1 to 5,

Y is a nitrogen atom or a phosphorus atom,

U is a carbon atom having a substituent R^6, a nitrogen atom

or a phosphorus atom,

Q is a carbon atom having a substituent R^7, a nitrogen atom or a phosphorus atom,

S is a carbon atom having a substituent R^8, a nitrogen atom or a phosphorus atom,

T is a carbon atom having a substituent R^9, a nitrogen atom or a phosphorous atom,

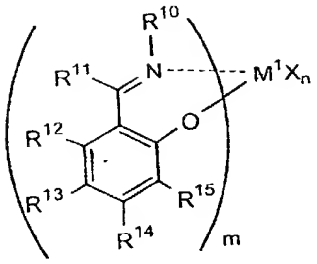
R^1 is an aromatic hydrocarbon group, an aliphatic hydrocarbon group or an alicyclic hydrocarbon group, selected from a phenyl group having, at least one position of the 2-position and the 6-position, when the position of the carbon atom bonded to nitrogen is the 1-position, one or more substituents selected from a halogen atom and a halogen-containing group, or a phenyl group having, at least one position of the 3-position, the 4-position and the 5-position, at least one substituent selected from a fluorine-containing group having one carbon atom and not more than two fluorine atoms, a fluorine-containing group having two or more carbon atoms, a chlorine atom, a bromine atom, an iodine atom, a chlorine-containing group, a bromine-containing group and an iodine-containing group, an aromatic hydrocarbon group other than a phenyl group having at least one substituent selected from a halogen atom and a halogen-containing group, an aliphatic hydrocarbon group having at least one substituent selected from a halogen atom and a halogen-containing group, or an alicyclic hydrocarbon group having at least one substituent selected from a halogen atom and a halogen-containing group,

R^6 to R^9 may be the same or different and are each a hydrogen atom, a halogen atom, a hydrocarbon group, a hydrocarbon-substituted silyl group, an oxygen-containing group, a nitrogen-containing group, a sulfur-containing group, a boron-containing group, an aluminum-containing group, a phosphorus-containing group, a halogen-containing group, a heterocyclic compound residue, a silicon-containing group, a germanium-containing group or a tin-containing group, two or more of R^6 to R^9 may be bonded to form a ring, and when m is 2 or greater, R^1s, R^6s, R^7, R^8s and R^9s may be the same or different, and one group of R^6 to R^9 contained in one ligand and one group of R^6 to R^9 contained in other ligands may be bonded,

n is a number satisfying a valence of M^1, and

X is an oxygen atom a hydrogen atom, a halogen atom, a hydrocarbon group, an oxygen-containing group, a sulfur-containing group, a nitrogen-containing group, a boron-containing group, an aluminum-containing group, a phosphorus-containing group, a halogen-containing group, a heterocyclic compound residue, a silicon-containing group, a germanium-containing group or a tin-containing group, and when n is 2 or greater, plural groups indicated by X may be the same or different, and plural groups indicated by X may be bonded to form a ring; and

a transition metal compound which is represented by the following formula (III)



(III)

wherein M^1 is a transition metal atom selected from Group 4 to Group 5 of the periodic table,

m is 1 or 2,

R^{10} is an aromatic hydrocarbon group, an aliphatic hydrocarbon group or an alicyclic hydrocarbon group, when R^{10} is a phenyl group and the position of the carbon atom bonded to nitrogen is the 1-position, this phenyl group has, at least one position of the 2-position and the 6-position, one or more substituents selected from a heteroatom and a heteroatom-containing group, or has, at least one position of the 3-position, the 4-position and the 5-position, at least one substituent selected from a heteroatom other than a fluorine atom, a fluorine-containing group having one carbon atom and not more than two fluorine atoms, a fluorine-containing group having two or more carbon atoms, and a group containing a heteroatom other than a fluorine atom, and when R^{10} is an aromatic hydrocarbon group other than a phenyl group, an aliphatic hydrocarbon group or an alicyclic group, this group has at least one substituent selected from a heteroatom and a heteroatom-containing group,

R^{11} to R^{14} may be the same or different and are each a

hydrogen atom, a halogen atom, a halogen-containing group, a hydrocarbon group, a hydrocarbon-substituted silyl group, an oxygen-containing group, a nitrogen-containing group or a sulfur-containing group,

R^{15} is a halogen atom, a halogen-containing group, a hydrocarbon group or a hydrocarbon-substituted silyl group,

n is a number satisfying a valence of M, and

X is an oxygen atom, a hydrogen atom, a halogen atom, a hydrocarbon group, an oxygen-containing group, a sulfur-containing group, a nitrogen-containing group, a boron-containing group, an aluminum-containing group, a phosphorus-containing group, a halogen-containing group, a heterocyclic compound residue, a silicon-containing group, a germanium-containing group or a tin-containing group, and when n is 2 or greater, plural groups indicated by X may be the same or different, and plural groups indicated by X may be bonded to form a ring.

42. (Amended) The process for preparing an olefin polymer as claimed in claim 39, wherein an olefin polymerization catalyst, an olefin polymer, the tapered polymer or the olefin block copolymer of claim 1, 7, 10 or 16 is prepared, said olefin polymerization catalyst comprising a transition metal compound selected from the group consisting of

a transition metal compound which is represented by the following formula (I) and has properties that, in a β-agostic structure of a cationic complex wherein one of X in the formula

(I) is replaced with a n-propyl group, said structure being measured by a density functional method, the distance between the heteroatom, which has no direct bond to the central metal M and is nearest to the central metal M, and hydrogen at the β-position is not more than 3.0 Å and the electrostatic energy is not more than 10kJ/mol,

$$L_mMX_n \qquad (I)$$

wherein M is a transition metal atom selected from Group 3 to Group 11 of the periodic table,

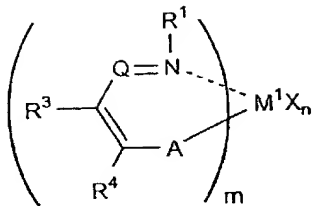
m is an integer of 1 to 5,

n is a number satisfying a valence of M,

L is a ligand coordinated to the central metal M and is a ligand having a heteroatom which has no direct bond to the central metal M, and

X is an oxygen atom, a hydrogen atom, a halogen atom, a hydrocarbon group, an oxygen-containing group, a sulfur-containing group, a nitrogen-containing group, a boron-containing group, an aluminum-containing group, a phosphorus-containing group, a halogen-containing group, a heterocyclic compound residue, a silicon-containing group, a germanium-containing group or a tin-containing group, and when n is 2 or greater, plural groups indicated by X my be the same or different, and plural groups indicated by X may be bonded to form a ring:

a transition metal compound which is represented by the following formula (II-a)



(II-a)

wherein M1 is a transition metal atom selected from Group 3 to Group 11 of the periodic table,

m is an integer of 1 to 5,

Q is a nitrogen atom or a carbon atom having a substituent R^2,

A is an oxygen atom, a sulfur atom, a selenium atom or a nitrogen atom having a substituent R^5,

R^1 is an aromatic hydrocarbon group, an aliphatic hydrocarbon group or an alicyclic hydrocarbon group, selected from a phenyl group having, at least one position of the 2-position and the 6-position, when the position of the carbon atom bonded to nitrogen is the 1-position, one or more substituents selected from a halogen atom and a halogen-containing group, or a phenyl group having, at least one position of the 3-position, the 4-position and the 5-position, and least one substituent selected from a fluorine-containing group having one carbon atom and not more than two fluorine atoms, a fluorine-containing group having two or more carbon atoms, a chlorine atom, a bromine atom, an iodine atom, a chlorine-containing group, a bromine-containing group and an iodine-containing group, an aromatic hydrocarbon group other than a phenyl group having at least one substituent

selected from a halogen atom and a halogen-containing group, an aliphatic hydrocarbon group having at least one substituent selected from a halogen atom and a halogen-containing group, or an alicyclic hydrocarbon group having at least one substituent selected from a halogen atom and a halogen-containing group,

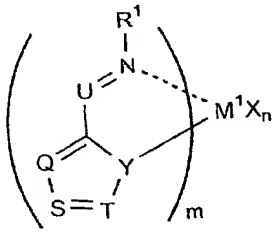
R^2 to R^5 may be the same or different and are each a hydrogen atom, a halogen atom, a hydrocarbon group, a hydrocarbon-substituted silyl group, an oxygen-containing group, a nitrogen-containing group, a sulfur-containing group, a boron-containing group, an aluminum-containing group, a phosphorus-containing group, a halogen-containing group, a heterocyclic compound residue, a silicon-containing group, a germanium-containing group, or a tin-containing group, two or more of R^2 to R^5 may be bonded to form a ring, and when m is 2 or greater, R^1s, R^2s, R^3s, R^4s, and R^5s may be the same or different, and one group of R^2 to R^5 contained in one ligand and one group of R^2 to R^5 contained in other ligands may be bonded,

n is a number satisfying a valence of M^1, and

X is an oxygen atom, a hydrogen atom, a halogen atom, a hydrocarbon group, an oxygen-containing group, a sulfur-containing group, a nitrogen-containing group, a boron-containing group, an aluminum-containing group, a phosphorus-containing group, a halogen-containing group, a heterocyclic compound residue, a silicon-containing group, a germanium-containing group or a tin-containing group, and when n is 2 or greater, plural groups indicated by X may be the same or different, and plural

groups indicated by X may be bonded to form a ring;

a transition metal compound which is represented by the following formula (II-b)



(II-b)

wherein M^1 is a transition metal atom selected from Group 3 to Group 11 of the periodic table,

m is an integer of 1 to 5,

Y is a nitrogen atom or a phosphorus atom,

U is a carbon atom having a substituent R^6, a nitrogen atom or a phosphorus atom,

Q is a carbon atom having a substituent R^7, a nitrogen atom or a phosphorus atom,

S is a carbon atom having a substituent R^8, a nitrogen atom or a phosphorus atom,

T is a carbon atom having a substituent R^9, a nitrogen atom or a phosphorous atom,

R^1 is an aromatic hydrocarbon group, an aliphatic hydrocarbon group or an alicyclic hydrocarbon group, selected from a phenyl group having, at least one position of the 2-position and the 6-position, when the position of the carbon atom

bonded to nitrogen is the 1-position, one or more substituents selected from a halogen atom and a halogen-containing group, or a phenyl group having, at least one position of the 3-position, the 4-position and the 5-position, at least one substituent selected from a fluorine-containing group having one carbon atom and not more than two fluorine atoms, a fluorine-containing group having two or more carbon atoms, a chlorine atom, a bromine atom, an iodine atom, a chlorine-containing group, a bromine-containing group and an iodine-containing group, an aromatic hydrocarbon group other than a phenyl group having at least one substituent selected from a halogen atom and a halogen-containing group, an aliphatic hydrocarbon group having at least one substituent selected from a halogen atom and a halogen-containing group, or an alicyclic hydrocarbon group having at least one substituent selected from a halogen atom and a halogen-containing group,

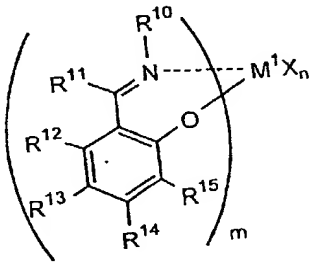
R^6 to R^9 may be the same or different and are each a hydrogen atom, a halogen atom, a hydrocarbon group, a hydrocarbon-substituted silyl group, an oxygen-containing group, a nitrogen-containing group, a sulfur-containing group, a boron-containing group, an aluminum-containing group, a phosphorus-containing group, a halogen-containing group, a heterocyclic compound residue, a silicon-containing group, a germanium-containing group or a tin-containing group, two or more of R^6 to R^9 may be bonded to form a ring, and when m is 2 or greater, R^1s, R^6s, R^7, R^8s and R^9s may be the same or different, and one group of R^6 to R^9 contained in one ligand and one group of R^6 to R^9

contained in other ligands may be bonded,

n is a number satisfying a valence of M^1, and

X is an oxygen atom a hydrogen atom, a halogen atom, a hydrocarbon group, an oxygen-containing group, a sulfur-containing group, a nitrogen-containing group, a boron-containing group, an aluminum-containing group, a phosphorus-containing group, a halogen-containing group, a heterocyclic compound residue, a silicon-containing group, a germanium-containing group or a tin-containing group, and when n is 2 or greater, plural groups indicated by X may be the same or different, and plural groups indicated by X may be bonded to form a ring; and

a transition metal compound which is represented by the following formula (III)



(III)

wherein M^1 is a transition metal atom selected from Group 4 to Group 5 of the periodic table,

m is 1 or 2,

R^{10} is an aromatic hydrocarbon group, an aliphatic hydrocarbon group or an alicyclic hydrocarbon group, when R^{10} is a phenyl group and the position of the carbon atom bonded to

nitrogen is the 1-position, this phenyl group has, at least one position of the 2-position and the 6-position, one or more substituents selected from a heteroatom and a heteroatom-containing group, or has, at least one position of the 3-position, the 4-position and the 5-position, at least one substituent selected from a heteroatom other than a fluorine atom, a fluorine-containing group having one carbon atom and not more than two fluorine atoms, a fluorine-containing group having two or more carbon atoms, and a group containing a heteroatom other than a fluorine atom, and when R^{10} is an aromatic hydrocarbon group other than a phenyl group, an aliphatic hydrocarbon group or an alicyclic group, this group has at least one substituent selected from a heteroatom and a heteroatom-containing group,

R^{11} to R^{14} may be the same or different and are each a hydrogen atom, a halogen atom, a halogen-containing group, a hydrocarbon group, a hydrocarbon-substituted silyl group, an oxygen-containing group, a nitrogen-containing group or a sulfur-containing group,

R^{15} is a halogen atom, a halogen-containing group, a hydrocarbon group or a hydrocarbon-substituted silyl group,

n is a number satisfying a valence of M, and

X is an oxygen atom, a hydrogen atom, a halogen atom, a hydrocarbon group, an oxygen-containing group, a sulfur-containing group, a nitrogen-containing group, a boron-containing group, an aluminum-containing group, a phosphorus-containing

group, a halogen-containing group, a heterocyclic compound residue, a silicon-containing group, a germanium-containing group or a tin-containing group, and when n is 2 or greater, plural groups indicated by X may be the same or different, and plural groups indicated by X may be bonded to form a ring.

REMARKS

The specification has been amended to provide a cross-reference to the previously filed International Application. The claims have also been amended to delete improper multiple dependencies and to place the application into better form for examination. Entry of the present amendment and favorable action on the above-identified application are earnestly solicited.

Attached hereto is a marked-up copy of the changes made to the application by this Amendment.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37 C.F.R. § 1.16 or under 37 C.F.R. § 1.17; particularly, extension of time fees.

Respectfully submitted,

BIRCH, STEWART, KOLASCH & BIRCH, LLP

By _____
Marc S. Weiner, #32,181

P.O. Box 747
Falls Church, VA 22040-0747
(703) 205-8000

MSW/jeb
1155-0226P

Attachment: Version With Markings Showing Changes Made

(Rev. 01/22/01)

VERSION WITH MARKINGS SHOWING CHANGES MADE

The specification has been amended to provide cross-referencing to the International Application.

The claims have been amended as follows:

15. (Amended) The olefin polymer as claimed in [any one of claims 11 to 14]claim 11, wherein a sequence of two or more continuous methylene groups is detected by means of ^{13}C-NMR, and a sequence of two consecutive methylene groups and a sequence of three or more consecutive methylene groups are both detected.

26. (Amended) The olefin polymer as claimed in [any one of] claims [1 to 25] 1, 7, 10, or 16, which has a functional group at the terminal of the main chain.

27. (Amended) A molded product comprising the olefin polymer of [any one of claims 1 to 25] 1, 7, 10, or 16.

34. (Amended) A process for preparing an olefin polymer, comprising polymerizing an olefin of 2 to 20 carbon atoms in the presence of an olefin polymerization catalyst comprising the transition metal compound of claim 32, to prepare the olefin polymer [of claim 7, 10 or 16].

35. (Amended) A process for preparing an olefin polymer,

comprising polymerizing an olefin of 2 to 20 carbon atoms in the presence of an olefin polymerization catalyst comprising [the] a transition metal compound [of any one of claims 28 to 34] to prepare a polymer and then bringing the polymer into contact with a functional group-containing compound to prepare an olefin polymer having a functional group at the terminal[.], said transition metal compound being selected from the group consisting of

a transition metal compound which is represented by the following formula (I) and has properties that, in a β-agostic structure of a cationic complex wherein one of X in the formula (I) is replaced with a n-propyl group, said structure being measured by a density functional method, the distance between the heteroatom, which has no direct bond to the central metal M and is nearest to the central metal M, and hydrogen at the β-position is not more than 3.0 Å and the electrostatic energy is not more than 10kJ/mol,

$$L_mMX_n \qquad (I)$$

wherein M is a transition metal atom selected from Group 3 to Group 11 of the periodic table,

m is an integer of 1 to 5,

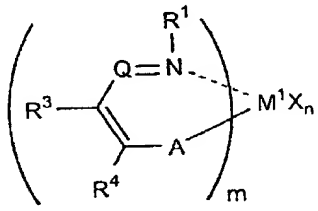
n is a number satisfying a valence of M,

L is a ligand coordinated to the central metal M and is a ligand having a heteroatom which has no direct bond to the central metal M, and

X is an oxygen atom, a hydrogen atom, a halogen atom, a

hydrocarbon group, an oxygen-containing group, a sulfur-containing group, a nitrogen-containing group, a boron-containing group, an aluminum-containing group, a phosphorus-containing group, a halogen-containing group, a heterocyclic compound residue, a silicon-containing group, a germanium-containing group or a tin-containing group, and when n is 2 or greater, plural groups indicated by X my be the same or different, and plural groups indicated by X may be bonded to form a ring:

a transition metal compound which is represented by the following formula (II-a)



(II-a)

wherein M is a transition metal atom selected from Group 3 to Group 11 of the periodic table,

m is an integer of 1 to 5,

Q is a nitrogen atom or a carbon atom having a substituent R^2,

A is an oxygen atom, a sulfur atom, a selenium atom or a nitrogen atom having a substituent R^5,

R^1 is an aromatic hydrocarbon group, an aliphatic hydrocarbon group or an alicyclic hydrocarbon group, selected from a phenyl group having, at least one position of the 2-

position and the 6-position, when the position of the carbon atom bonded to nitrogen is the 1-position, one or more substituents selected from a halogen atom and a halogen-containing group, or a phenyl group having, at least one position of the 3-position, the 4-position and the 5-position, and least one substituent selected from a fluorine-containing group having one carbon atom and not more than two fluorine atoms, a fluorine-containing group having two or more carbon atoms, a chlorine atom, a bromine atom, an iodine atom, a chlorine-containing group, a bromine-containing group and an iodine-containing group, an aromatic hydrocarbon group other than a phenyl group having at least one substituent selected from a halogen atom and a halogen-containing group, an aliphatic hydrocarbon group having at least one substituent selected from a halogen atom and a halogen-containing group, or an alicyclic hydrocarbon group having at least one substituent selected from a halogen atom and a halogen-containing group,

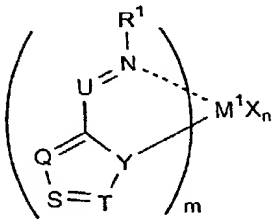
R^2 to R^5 may be the same or different and are each a hydrogen atom, a halogen atom, a hydrocarbon group, a hydrocarbon-substituted silyl group, an oxygen-containing group, a nitrogen-containing group, a sulfur-containing group, a boron-containing group, an aluminum-containing group, a phosphorus-containing group, a halogen-containing group, a heterocyclic compound residue, a silicon-containing group, a germanium-containing group, or a tin-containing group, two or more of R^2 to R^5 may be bonded to form a ring, and when m is 2 or greater, R^1s, R^2s, R^3s, R^4s, and R^5s may be the same or different, and one group

of R^2 to R^5 contained in one ligand and one group of R^2 to R^5 contained in other ligands may be bonded,

n is a number satisfying a valence of M^1, and

X is an oxygen atom, a hydrogen atom, a halogen atom, a hydrocarbon group, an oxygen-containing group, a sulfur-containing group, a nitrogen-containing group, a boron-containing group, an aluminum-containing group, a phosphorus-containing group, a halogen-containing group, a heterocyclic compound residue, a silicon-containing group, a germanium-containing group or a tin-containing group, and when n is 2 or greater, plural groups indicated by X may be the same or different, and plural groups indicated by X may be bonded to form a ring;

a transition metal compound which is represented by the following formula (II-b)



(II-b)

wherein M^1 is a transition metal atom selected from Group 3 to Group 11 of the periodic table,

m is an integer of 1 to 5,

Y is a nitrogen atom or a phosphorus atom,

U is a carbon atom having a substituent R^6, a nitrogen atom

or a phosphorus atom,

Q is a carbon atom having a substituent R^7, a nitrogen atom or a phosphorus atom,

S is a carbon atom having a substituent R^8, a nitrogen atom or a phosphorus atom,

T is a carbon atom having a substituent R^9, a nitrogen atom or a phosphorous atom,

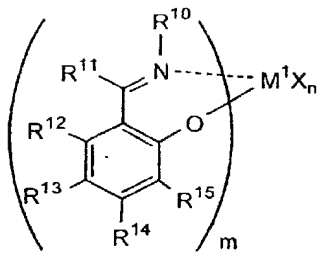
R^1 is an aromatic hydrocarbon group, an aliphatic hydrocarbon group or an alicyclic hydrocarbon group, selected from a phenyl group having, at least one position of the 2-position and the 6-position, when the position of the carbon atom bonded to nitrogen is the 1-position, one or more substituents selected from a halogen atom and a halogen-containing group, or a phenyl group having, at least one position of the 3-position, the 4-position and the 5-position, at least one substituent selected from a fluorine-containing group having one carbon atom and not more than two fluorine atoms, a fluorine-containing group having two or more carbon atoms, a chlorine atom, a bromine atom, an iodine atom, a chlorine-containing group, a bromine-containing group and an iodine-containing group, an aromatic hydrocarbon group other than a phenyl group having at least one substituent selected from a halogen atom and a halogen-containing group, an aliphatic hydrocarbon group having at least one substituent selected from a halogen atom and a halogen-containing group, or an alicyclic hydrocarbon group having at least one substituent selected from a halogen atom and a halogen-containing group,

R^6 to R^9 may be the same or different and are each a hydrogen atom, a halogen atom, a hydrocarbon group, a hydrocarbon-substituted silyl group, an oxygen-containing group, a nitrogen-containing group, a sulfur-containing group, a boron-containing group, an aluminum-containing group, a phosphorus-containing group, a halogen-containing group, a heterocyclic compound residue, a silicon-containing group, a germanium-containing group or a tin-containing group, two or more of R^6 to R^9 may be bonded to form a ring, and when m is 2 or greater, R^1s, R^6s, R^7, R^8s and R^9s may be the same or different, and one group of R^6 to R^9 contained in one ligand and one group of R^6 to R^9 contained in other ligands may be bonded,

n is a number satisfying a valence of M^1, and

X is an oxygen atom a hydrogen atom, a halogen atom, a hydrocarbon group, an oxygen-containing group, a sulfur-containing group, a nitrogen-containing group, a boron-containing group, an aluminum-containing group, a phosphorus-containing group, a halogen-containing group, a heterocyclic compound residue, a silicon-containing group, a germanium-containing group or a tin-containing group, and when n is 2 or greater, plural groups indicated by X may be the same or different, and plural groups indicated by X may be bonded to form a ring; and

a transition metal compound which is represented by the following formula (III)



(III)

wherein M^1 is a transition metal atom selected from Group 4 to Group 5 of the periodic table,

m is 1 or 2,

R^{10} is an aromatic hydrocarbon group, an aliphatic hydrocarbon group or an alicyclic hydrocarbon group, when R^{10} is a phenyl group and the position of the carbon atom bonded to nitrogen is the 1-position, this phenyl group has, at least one position of the 2-position and the 6-position, one or more substituents selected from a heteroatom and a heteroatom-containing group, or has, at least one position of the 3-position, the 4-position and the 5-position, at least one substituent selected from a heteroatom other than a fluorine atom, a fluorine-containing group having one carbon atom and not more than two fluorine atoms, a fluorine-containing group having two or more carbon atoms, and a group containing a heteroatom other than a fluorine atom, and when R^{10} is an aromatic hydrocarbon group other than a phenyl group, an aliphatic hydrocarbon group or an alicyclic group, this group has at least one substituent selected from a heteroatom and a heteroatom-containing group,

R^{11} to R^{14} may be the same or different and are each a

hydrogen atom, a halogen atom, a halogen-containing group, a hydrocarbon group, a hydrocarbon-substituted silyl group, an oxygen-containing group, a nitrogen-containing group or a sulfur-containing group,

R^{15} is a halogen atom, a halogen-containing group, a hydrocarbon group or a hydrocarbon-substituted silyl group,

n is a number satisfying a valence of M, and

X is an oxygen atom, a hydrogen atom, a halogen atom, a hydrocarbon group, an oxygen-containing group, a sulfur-containing group, a nitrogen-containing group, a boron-containing group, an aluminum-containing group, a phosphorus-containing group, a halogen-containing group, a heterocyclic compound residue, a silicon-containing group, a germanium-containing group or a tin-containing group, and when n is 2 or greater, plural groups indicated by X may be the same or different, and plural groups indicated by X may be bonded to form a ring.

36. (Amended) A process for preparing an olefin polymer, comprising polymerizing at least two olefins which are selected from olefins of 2 to 20 carbon atoms and have different polymerization reactivities, in the presence of an olefin polymerization catalyst comprising [the] a transition metal compound [of any one of claims 28 to 34] to prepare a tapered polymer containing a segment wherein composition of two or more monomers continuously changes[.], said transition metal compound being selected from the group consisting of

a transition metal compound which is represented by the following formula (I) and has properties that, in a β-agostic structure of a cationic complex wherein one of X in the formula (I) is replaced with a n-propyl group, said structure being measured by a density functional method, the distance between the heteroatom, which has no direct bond to the central metal M and is nearest to the central metal M, and hydrogen at the β-position is not more than 3.0 Å and the electrostatic energy is not more than 10kJ/mol,

$$L_mMX_n \qquad (I)$$

wherein M is a transition metal atom selected from Group 3 to Group 11 of the periodic table,

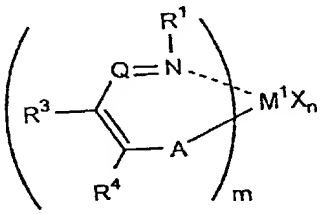
m is an integer of 1 to 5,

n is a number satisfying a valence of M,

L is a ligand coordinated to the central metal M and is a ligand having a heteroatom which has no direct bond to the central metal M, and

X is an oxygen atom, a hydrogen atom, a halogen atom, a hydrocarbon group, an oxygen-containing group, a sulfur-containing group, a nitrogen-containing group, a boron-containing group, an aluminum-containing group, a phosphorus-containing group, a halogen-containing group, a heterocyclic compound residue, a silicon-containing group, a germanium-containing group or a tin-containing group, and when n is 2 or greater, plural groups indicated by X my be the same or different, and plural groups indicated by X may be bonded to form a ring:

a transition metal compound which is represented by the following formula (II-a)



(II-a)

wherein M^1 is a transition metal atom selected from Group 3 to Group 11 of the periodic table,

m is an integer of 1 to 5,

Q is a nitrogen atom or a carbon atom having a substituent R^2,

A is an oxygen atom, a sulfur atom, a selenium atom or a nitrogen atom having a substituent R^5,

R^1 is an aromatic hydrocarbon group, an aliphatic hydrocarbon group or an alicyclic hydrocarbon group, selected from a phenyl group having, at least one position of the 2-position and the 6-position, when the position of the carbon atom bonded to nitrogen is the 1-position, one or more substituents selected from a halogen atom and a halogen-containing group, or a phenyl group having, at least one position of the 3-position, the 4-position and the 5-position, and least one substituent selected from a fluorine-containing group having one carbon atom and not more than two fluorine atoms, a fluorine-containing group having two or more carbon atoms, a chlorine atom, a bromine atom, an

iodine atom, a chlorine-containing group, a bromine-containing group and an iodine-containing group, an aromatic hydrocarbon group other than a phenyl group having at least one substituent selected from a halogen atom and a halogen-containing group, an aliphatic hydrocarbon group having at least one substituent selected from a halogen atom and a halogen-containing group, or an alicyclic hydrocarbon group having at least one substituent selected from a halogen atom and a halogen-containing group,

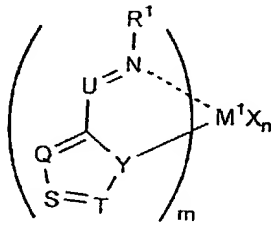
R^2 to R^5 may be the same or different and are each a hydrogen atom, a halogen atom, a hydrocarbon group, a hydrocarbon-substituted silyl group, an oxygen-containing group, a nitrogen-containing group, a sulfur-containing group, a boron-containing group, an aluminum-containing group, a phosphorus-containing group, a halogen-containing group, a heterocyclic compound residue, a silicon-containing group, a germanium-containing group, or a tin-containing group, two or more of R^2 to R^5 may be bonded to form a ring, and when m is 2 or greater, R^1s, R^2s, R^3s, R^4s, and R^5s may be the same or different, and one group of R^2 to R^5 contained in one ligand and one group of R^2 to R^5 contained in other ligands may be bonded,

n is a number satisfying a valence of M^1, and

X is an oxygen atom, a hydrogen atom, a halogen atom, a hydrocarbon group, an oxygen-containing group, a sulfur-containing group, a nitrogen-containing group, a boron-containing group, an aluminum-containing group, a phosphorus-containing group, a halogen-containing group, a heterocyclic compound

residue, a silicon-containing group, a germanium-containing group or a tin-containing group, and when n is 2 or greater, plural groups indicated by X may be the same or different, and plural groups indicated by X may be bonded to form a ring;

a transition metal compound which is represented by the following formula (II-b)



(II-b)

wherein M^1 is a transition metal atom selected from Group 3 to Group 11 of the periodic table,

m is an integer of 1 to 5,

Y is a nitrogen atom or a phosphorus atom,

U is a carbon atom having a substituent R^6, a nitrogen atom or a phosphorus atom,

Q is a carbon atom having a substituent R^7, a nitrogen atom or a phosphorus atom,

S is a carbon atom having a substituent R^8, a nitrogen atom or a phosphorus atom,

T is a carbon atom having a substituent R^9, a nitrogen atom or a phosphorous atom,

R^1 is an aromatic hydrocarbon group, an aliphatic

hydrocarbon group or an alicyclic hydrocarbon group, selected from a phenyl group having, at least one position of the 2-position and the 6-position, when the position of the carbon atom bonded to nitrogen is the 1-position, one or more substituents selected from a halogen atom and a halogen-containing group, or a phenyl group having, at least one position of the 3-position, the 4-position and the 5-position, at least one substituent selected from a fluorine-containing group having one carbon atom and not more than two fluorine atoms, a fluorine-containing group having two or more carbon atoms, a chlorine atom, a bromine atom, an iodine atom, a chlorine-containing group, a bromine-containing group and an iodine-containing group, an aromatic hydrocarbon group other than a phenyl group having at least one substituent selected from a halogen atom and a halogen-containing group, an aliphatic hydrocarbon group having at least one substituent selected from a halogen atom and a halogen-containing group, or an alicyclic hydrocarbon group having at least one substituent selected from a halogen atom and a halogen-containing group,

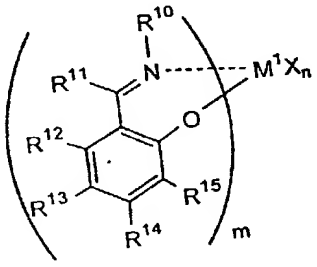
R^6 to R^9 may be the same or different and are each a hydrogen atom, a halogen atom, a hydrocarbon group, a hydrocarbon-substituted silyl group, an oxygen-containing group, a nitrogen-containing group, a sulfur-containing group, a boron-containing group, an aluminum-containing group, a phosphorus-containing group, a halogen-containing group, a heterocyclic compound residue, a silicon-containing group, a germanium-containing group or a tin-containing group, two or more of R^6 to

R^9 may be bonded to form a ring, and when m is 2 or greater, R^1s, R^6s, R^7, R^8s and R^9s may be the same or different, and one group of R^6 to R^9 contained in one ligand and one group of R^6 to R^9 contained in other ligands may be bonded,

n is a number satisfying a valence of M^1, and

X is an oxygen atom a hydrogen atom, a halogen atom, a hydrocarbon group, an oxygen-containing group, a sulfur-containing group, a nitrogen-containing group, a boron-containing group, an aluminum-containing group, a phosphorus-containing group, a halogen-containing group, a heterocyclic compound residue, a silicon-containing group, a germanium-containing group or a tin-containing group, and when n is 2 or greater, plural groups indicated by X may be the same or different, and plural groups indicated by X may be bonded to form a ring; and

a transition metal compound which is represented by the following formula (III)



(III)

wherein M^1 is a transition metal atom selected from Group 4 to Group 5 of the periodic table,

m is 1 or 2,

R^{10} is an aromatic hydrocarbon group, an aliphatic hydrocarbon group or an alicyclic hydrocarbon group, when R^{10} is a phenyl group and the position of the carbon atom bonded to nitrogen is the 1-position, this phenyl group has, at least one position of the 2-position and the 6-position, one or more substituents selected from a heteroatom and a heteroatom-containing group, or has, at least one position of the 3-position, the 4-position and the 5-position, at least one substituent selected from a heteroatom other than a fluorine atom, a fluorine-containing group having one carbon atom and not more than two fluorine atoms, a fluorine-containing group having two or more carbon atoms, and a group containing a heteroatom other than a fluorine atom, and when R^{10} is an aromatic hydrocarbon group other than a phenyl group, an aliphatic hydrocarbon group or an alicyclic group, this group has at least one substituent selected from a heteroatom and a heteroatom-containing group,

R^{11} to R^{14} may be the same or different and are each a hydrogen atom, a halogen atom, a halogen-containing group, a hydrocarbon group, a hydrocarbon-substituted silyl group, an oxygen-containing group, a nitrogen-containing group or a sulfur-containing group,

R^{15} is a halogen atom, a halogen-containing group, a hydrocarbon group or a hydrocarbon-substituted silyl group,

n is a number satisfying a valence of M, and

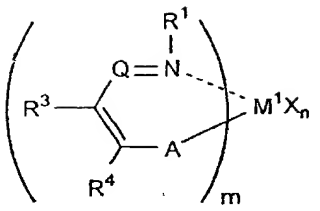
X is an oxygen atom, a hydrogen atom, a halogen atom, a

hydrocarbon group, an oxygen-containing group, a sulfur-containing group, a nitrogen-containing group, a boron-containing group, an aluminum-containing group, a phosphorus-containing group, a halogen-containing group, a heterocyclic compound residue, a silicon-containing group, a germanium-containing group or a tin-containing group, and when n is 2 or greater, plural groups indicated by X may be the same or different, and plural groups indicated by X may be bonded to form a ring.

37. (Amended) A process for preparing an olefin polymer, comprising conducting the following step (1), the following step (2), and optionally, the following step (3) of an arbitrary number of times, to prepare a block copolymer having structure wherein plural polymer blocks are bonded;

(1) a step of polymerizing at least one olefin selected from olefins of 2 to 20 carbon atoms in the presence of an olefin polymerization catalyst comprising [the] a transition metal compound [of any one of claims 28 to 34] to prepare a polymer block, said transition metal compound being selected from the group consisting of

a transition metal compound which is represented by the following formula (I) and has properties that, in a β-agostic structure of a cationic complex wherein one of X in the formula (I) is replaced with a n-propyl group, said structure being measured by a density functional method, the distance between the heteroatom, which has no direct bond to the central metal M and



(II-a)

wherein M^1 is a transition metal atom selected from Group 3 to Group 11 of the periodic table,

m is an integer of 1 to 5,

Q is a nitrogen atom or a carbon atom having a substituent R^2,

A is an oxygen atom, a sulfur atom, a selenium atom or a nitrogen atom having a substituent R^5,

R^1 is an aromatic hydrocarbon group, an aliphatic hydrocarbon group or an alicyclic hydrocarbon group, selected from a phenyl group having, at least one position of the 2-position and the 6-position, when the position of the carbon atom bonded to nitrogen is the 1-position, one or more substituents selected from a halogen atom and a halogen-containing group, or a phenyl group having, at least one position of the 3-position, the 4-position and the 5-position, and least one substituent selected from a fluorine-containing group having one carbon atom and not more than two fluorine atoms, a fluorine-containing group having two or more carbon atoms, a chlorine atom, a bromine atom, an iodine atom, a chlorine-containing group, a bromine-containing group and an iodine-containing group, an aromatic hydrocarbon group other than a phenyl group having at least one substituent selected from a halogen atom and a halogen-containing group, an aliphatic hydrocarbon group having at least one substituent selected from a halogen atom and a halogen-containing group, or

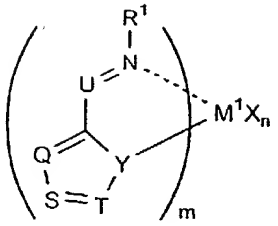
an alicyclic hydrocarbon group having at least one substituent selected from a halogen atom and a halogen-containing group,

R^2 to R^5 may be the same or different and are each a hydrogen atom, a halogen atom, a hydrocarbon group, a hydrocarbon-substituted silyl group, an oxygen-containing group, a nitrogen-containing group, a sulfur-containing group, a boron-containing group, an aluminum-containing group, a phosphorus-containing group, a halogen-containing group, a heterocyclic compound residue, a silicon-containing group, a germanium-containing group, or a tin-containing group, two or more of R^2 to R^5 may be bonded to form a ring, and when m is 2 or greater, R^1s, R^2s, R^3s, R^4s, and R^5s may be the same or different, and one group of R^2 to R^5 contained in one ligand and one group of R^2 to R^5 contained in other ligands may be bonded,

n is a number satisfying a valence of M^1, and

X is an oxygen atom, a hydrogen atom, a halogen atom, a hydrocarbon group, an oxygen-containing group, a sulfur-containing group, a nitrogen-containing group, a boron-containing group, an aluminum-containing group, a phosphorus-containing group, a halogen-containing group, a heterocyclic compound residue, a silicon-containing group, a germanium-containing group or a tin-containing group, and when n is 2 or greater, plural groups indicated by X may be the same or different, and plural groups indicated by X may be bonded to form a ring;

a transition metal compound which is represented by the following formula (II-b)



(II-b)

wherein M^1 is a transition metal atom selected from Group 3 to Group 11 of the periodic table,

m is an integer of 1 to 5,

Y is a nitrogen atom or a phosphorus atom,

U is a carbon atom having a substituent R^6, a nitrogen atom or a phosphorus atom,

Q is a carbon atom having a substituent R^7, a nitrogen atom or a phosphorus atom,

S is a carbon atom having a substituent R^8, a nitrogen atom or a phosphorus atom,

T is a carbon atom having a substituent R^9, a nitrogen atom or a phosphorous atom,

R^1 is an aromatic hydrocarbon group, an aliphatic hydrocarbon group or an alicyclic hydrocarbon group, selected from a phenyl group having, at least one position of the 2-position and the 6-position, when the position of the carbon atom bonded to nitrogen is the 1-position, one or more substituents selected from a halogen atom and a halogen-containing group, or a phenyl group having, at least one position of the 3-position, the

4-position and the 5-position, at least one substituent selected from a fluorine-containing group having one carbon atom and not more than two fluorine atoms, a fluorine-containing group having two or more carbon atoms, a chlorine atom, a bromine atom, an iodine atom, a chlorine-containing group, a bromine-containing group and an iodine-containing group, an aromatic hydrocarbon group other than a phenyl group having at least one substituent selected from a halogen atom and a halogen-containing group, an aliphatic hydrocarbon group having at least one substituent selected from a halogen atom and a halogen-containing group, or an alicyclic hydrocarbon group having at least one substituent selected from a halogen atom and a halogen-containing group,

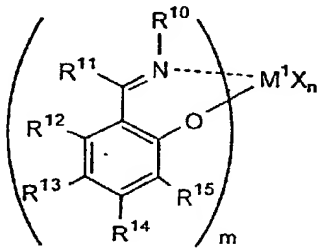
R^6 to R^9 may be the same or different and are each a hydrogen atom, a halogen atom, a hydrocarbon group, a hydrocarbon-substituted silyl group, an oxygen-containing group, a nitrogen-containing group, a sulfur-containing group, a boron-containing group, an aluminum-containing group, a phosphorus-containing group, a halogen-containing group, a heterocyclic compound residue, a silicon-containing group, a germanium-containing group or a tin-containing group, two or more of R^6 to R^9 may be bonded to form a ring, and when m is 2 or greater, R^1s, R^6s, R^7, R^8s and R^9s may be the same or different, and one group of R^6 to R^9 contained in one ligand and one group of R^6 to R^9 contained in other ligands may be bonded,

n is a number satisfying a valence of M^1, and

X is an oxygen atom a hydrogen atom, a halogen atom, a

hydrocarbon group, an oxygen-containing group, a sulfur-containing group, a nitrogen-containing group, a boron-containing group, an aluminum-containing group, a phosphorus-containing group, a halogen-containing group, a heterocyclic compound residue, a silicon-containing group, a germanium-containing group or a tin-containing group, and when n is 2 or greater, plural groups indicated by X may be the same or different, and plural groups indicated by X may be bonded to form a ring; and

a transition metal compound which is represented by the following formula (III)



(III)

wherein M^1 is a transition metal atom selected from Group 4 to Group 5 of the periodic table,

m is 1 or 2,

R^{10} is an aromatic hydrocarbon group, an aliphatic hydrocarbon group or an alicyclic hydrocarbon group, when R^{10} is a phenyl group and the position of the carbon atom bonded to nitrogen is the 1-position, this phenyl group has, at least one position of the 2-position and the 6-position, one or more substituents selected from a heteroatom and a heteroatom-

containing group, or has, at least one position of the 3-position, the 4-position and the 5-position, at least one substituent selected from a heteroatom other than a fluorine atom, a fluorine-containing group having one carbon atom and not more than two fluorine atoms, a fluorine-containing group having two or more carbon atoms, and a group containing a heteroatom other than a fluorine atom, and when R^{10} is an aromatic hydrocarbon group other than a phenyl group, an aliphatic hydrocarbon group or an alicyclic group, this group has at least one substituent selected from a heteroatom and a heteroatom-containing group,

R^{11} to R^{14} may be the same or different and are each a hydrogen atom, a halogen atom, a halogen-containing group, a hydrocarbon group, a hydrocarbon-substituted silyl group, an oxygen-containing group, a nitrogen-containing group or a sulfur-containing group,

R^{15} is a halogen atom, a halogen-containing group, a hydrocarbon group or a hydrocarbon-substituted silyl group,

n is a number satisfying a valence of M, and

X is an oxygen atom, a hydrogen atom, a halogen atom, a hydrocarbon group, an oxygen-containing group, a sulfur-containing group, a nitrogen-containing group, a boron-containing group, an aluminum-containing group, a phosphorus-containing group, a halogen-containing group, a heterocyclic compound residue, a silicon-containing group, a germanium-containing group or a tin-containing group, and when n is 2 or greater, plural

groups indicated by X may be the same or different, and plural groups indicated by X may be bonded to form a ring,

(2) a step of polymerizing at least one olefin selected from olefins of 2 to 20 carbon atoms in the presence of the polymer block prepared in the step (1) to prepare a polymer block which is different from the polymer block prepared in the step (1), and

(3) a step of polymerizing at least one olefin selected from olefins of 2 to 20 carbon atoms in the presence of the polymer block prepared in the step (1) and the polymer block prepared in the step (2) to prepare a polymer block which is different from the polymer blocks prepared in the previous step.

41. (Amended) The process for preparing an olefin polymer as claimed in claim 39 [or 40], wherein the olefin polymerization catalyst is the catalyst [of any one of claims 28 to 24] comprising a transition metal compound selected from the group consisting of

a transition metal compound which is represented by the following formula (I) and has properties that, in a β-agostic structure of a cationic complex wherein one of X in the formula (I) is replaced with a n-propyl group, said structure being measured by a density functional method, the distance between the heteroatom, which has no direct bond to the central metal M and is nearest to the central metal M, and hydrogen at the β-position is not more than 3.0 Å and the electrostatic energy is not more than 10kJ/mol,

L_mMX_n (I)

wherein M is a transition metal atom selected from Group 3 to Group 11 of the periodic table,

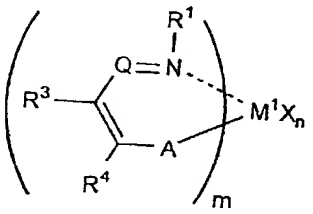
m is an integer of 1 to 5,

n is a number satisfying a valence of M,

L is a ligand coordinated to the central metal M and is a ligand having a heteroatom which has no direct bond to the central metal M, and

X is an oxygen atom, a hydrogen atom, a halogen atom, a hydrocarbon group, an oxygen-containing group, a sulfur-containing group, a nitrogen-containing group, a boron-containing group, an aluminum-containing group, a phosphorus-containing group, a halogen-containing group, a heterocyclic compound residue, a silicon-containing group, a germanium-containing group or a tin-containing group, and when n is 2 or greater, plural groups indicated by X my be the same or different, and plural groups indicated by X may be bonded to form a ring:

a transition metal compound which is represented by the following formula (II-a)



(II-a)

wherein M1 is a transition metal atom selected from Group 3 to

Group 11 of the periodic table,

m is an integer of 1 to 5,

Q is a nitrogen atom or a carbon atom having a substituent R2,

A is an oxygen atom, a sulfur atom, a selenium atom or a nitrogen atom having a substituent R5,

R^1 is an aromatic hydrocarbon group, an aliphatic hydrocarbon group or an alicyclic hydrocarbon group, selected from a phenyl group having, at least one position of the 2-position and the 6-position, when the position of the carbon atom bonded to nitrogen is the 1-position, one or more substituents selected from a halogen atom and a halogen-containing group, or a phenyl group having, at least one position of the 3-position, the 4-position and the 5-position, and least one substituent selected from a fluorine-containing group having one carbon atom and not more than two fluorine atoms, a fluorine-containing group having two or more carbon atoms, a chlorine atom, a bromine atom, an iodine atom, a chlorine-containing group, a bromine-containing group and an iodine-containing group, an aromatic hydrocarbon group other than a phenyl group having at least one substituent selected from a halogen atom and a halogen-containing group, an aliphatic hydrocarbon group having at least one substituent selected from a halogen atom and a halogen-containing group, or an alicyclic hydrocarbon group having at least one substituent selected from a halogen atom and a halogen-containing group,

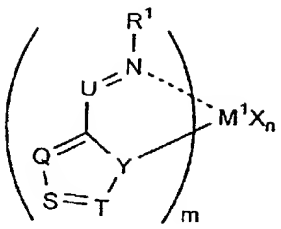
R^2 to R^5 may be the same or different and are each a

hydrogen atom, a halogen atom, a hydrocarbon group, a hydrocarbon-substituted silyl group, an oxygen-containing group, a nitrogen-containing group, a sulfur-containing group, a boron-containing group, an aluminum-containing group, a phosphorus-containing group, a halogen-containing group, a heterocyclic compound residue, a silicon-containing group, a germanium-containing group, or a tin-containing group, two or more of R^2 to R^5 may be bonded to form a ring, and when m is 2 or greater, R^1s, R^2s, R^3s, R^4s, and R^5s may be the same or different, and one group of R^2 to R^5 contained in one ligand and one group of R^2 to R^5 contained in other ligands may be bonded,

n is a number satisfying a valence of M^1, and

X is an oxygen atom, a hydrogen atom, a halogen atom, a hydrocarbon group, an oxygen-containing group, a sulfur-containing group, a nitrogen-containing group, a boron-containing group, an aluminum-containing group, a phosphorus-containing group, a halogen-containing group, a heterocyclic compound residue, a silicon-containing group, a germanium-containing group or a tin-containing group, and when n is 2 or greater, plural groups indicated by X may be the same or different, and plural groups indicated by X may be bonded to form a ring;

a transition metal compound which is represented by the following formula (II-b)



(II-b)

wherein M^1 is a transition metal atom selected from Group 3 to Group 11 of the periodic table,

m is an integer of 1 to 5,

Y is a nitrogen atom or a phosphorus atom,

U is a carbon atom having a substituent R^6, a nitrogen atom or a phosphorus atom,

Q is a carbon atom having a substituent R^7, a nitrogen atom or a phosphorus atom,

S is a carbon atom having a substituent R^8, a nitrogen atom or a phosphorus atom,

T is a carbon atom having a substituent R^9, a nitrogen atom or a phosphorous atom,

R^1 is an aromatic hydrocarbon group, an aliphatic hydrocarbon group or an alicyclic hydrocarbon group, selected from a phenyl group having, at least one position of the 2-position and the 6-position, when the position of the carbon atom bonded to nitrogen is the 1-position, one or more substituents selected from a halogen atom and a halogen-containing group, or a phenyl group having, at least one position of the 3-position, the 4-position and the 5-position, at least one substituent selected from a fluorine-containing group having one carbon atom and not more than two fluorine atoms, a fluorine-containing group having two or more carbon atoms, a chlorine atom, a bromine atom, an

iodine atom, a chlorine-containing group, a bromine-containing group and an iodine-containing group, an aromatic hydrocarbon group other than a phenyl group having at least one substituent selected from a halogen atom and a halogen-containing group, an aliphatic hydrocarbon group having at least one substituent selected from a halogen atom and a halogen-containing group, or an alicyclic hydrocarbon group having at least one substituent selected from a halogen atom and a halogen-containing group,

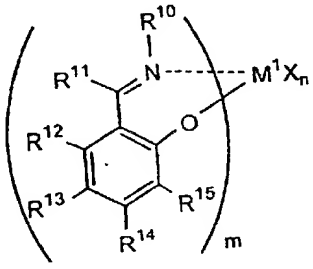
R^6 to R^9 may be the same or different and are each a hydrogen atom, a halogen atom, a hydrocarbon group, a hydrocarbon-substituted silyl group, an oxygen-containing group, a nitrogen-containing group, a sulfur-containing group, a boron-containing group, an aluminum-containing group, a phosphorus-containing group, a halogen-containing group, a heterocyclic compound residue, a silicon-containing group, a germanium-containing group or a tin-containing group, two or more of R^6 to R^9 may be bonded to form a ring, and when m is 2 or greater, R^1s, R^6s, R^7, R^8s and R^9s may be the same or different, and one group of R^6 to R^9 contained in one ligand and one group of R^6 to R^9 contained in other ligands may be bonded,

n is a number satisfying a valence of M^1, and

X is an oxygen atom a hydrogen atom, a halogen atom, a hydrocarbon group, an oxygen-containing group, a sulfur-containing group, a nitrogen-containing group, a boron-containing group, an aluminum-containing group, a phosphorus-containing group, a halogen-containing group, a heterocyclic compound

residue, a silicon-containing group, a germanium-containing group or a tin-containing group, and when n is 2 or greater, plural groups indicated by X may be the same or different, and plural groups indicated by X may be bonded to form a ring; and

a transition metal compound which is represented by the following formula (III)



(III)

wherein M^1 is a transition metal atom selected from Group 4 to Group 5 of the periodic table,

m is 1 or 2,

R^{10} is an aromatic hydrocarbon group, an aliphatic hydrocarbon group or an alicyclic hydrocarbon group, when R^{10} is a phenyl group and the position of the carbon atom bonded to nitrogen is the 1-position, this phenyl group has, at least one position of the 2-position and the 6-position, one or more substituents selected from a heteroatom and a heteroatom-containing group, or has, at least one position of the 3-position, the 4-position and the 5-position, at least one substituent selected from a heteroatom other than a fluorine atom, a fluorine-containing group having one carbon atom and not

more than two fluorine atoms, a fluorine-containing group having two or more carbon atoms, and a group containing a heteroatom other than a fluorine atom, and when R^{10} is an aromatic hydrocarbon group other than a phenyl group, an aliphatic hydrocarbon group or an alicyclic group, this group has at least one substituent selected from a heteroatom and a heteroatom-containing group,

R^{11} to R^{14} may be the same or different and are each a hydrogen atom, a halogen atom, a halogen-containing group, a hydrocarbon group, a hydrocarbon-substituted silyl group, an oxygen-containing group, a nitrogen-containing group or a sulfur-containing group,

R^{15} is a halogen atom, a halogen-containing group, a hydrocarbon group or a hydrocarbon-substituted silyl group,

n is a number satisfying a valence of M, and

X is an oxygen atom, a hydrogen atom, a halogen atom, a hydrocarbon group, an oxygen-containing group, a sulfur-containing group, a nitrogen-containing group, a boron-containing group, an aluminum-containing group, a phosphorus-containing group, a halogen-containing group, a heterocyclic compound residue, a silicon-containing group, a germanium-containing group or a tin-containing group, and when n is 2 or greater, plural groups indicated by X may be the same or different, and plural groups indicated by X may be bonded to form a ring.

42. (Amended) The process for preparing an olefin polymer as

claimed in claim 39 [or 40], wherein [the] an olefin polymerization catalyst [is the catalyst of any one of claims 28 to 34], [and the] an olefin polymer, the tapered polymer or the olefin block copolymer of claim 1, 7, 10 or 16 is prepared[.] , said olefin polymerization catalyst comprising a transition metal compound selected from the group consisting of

a transition metal compound which is represented by the following formula (I) and has properties that, in a β-agostic structure of a cationic complex wherein one of X in the formula (I) is replaced with a n-propyl group, said structure being measured by a density functional method, the distance between the heteroatom, which has no direct bond to the central metal M and is nearest to the central metal M, and hydrogen at the β-position is not more than 3.0 Å and the electrostatic energy is not more than 10kJ/mol,

$$L_mMX_n \qquad (I)$$

wherein M is a transition metal atom selected from Group 3 to Group 11 of the periodic table,

m is an integer of 1 to 5,

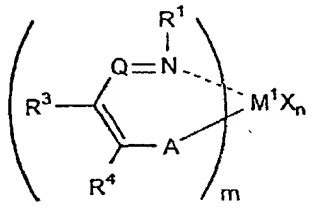
n is a number satisfying a valence of M,

L is a ligand coordinated to the central metal M and is a ligand having a heteroatom which has no direct bond to the central metal M, and

X is an oxygen atom, a hydrogen atom, a halogen atom, a hydrocarbon group, an oxygen-containing group, a sulfur-containing group, a nitrogen-containing group, a boron-containing

group, an aluminum-containing group, a phosphorus-containing group, a halogen-containing group, a heterocyclic compound residue, a silicon-containing group, a germanium-containing group or a tin-containing group, and when n is 2 or greater, plural groups indicated by X my be the same or different, and plural groups indicated by X may be bonded to form a ring:

a transition metal compound which is represented by the following formula (II-a)



(II-a)

wherein M1 is a transition metal atom selected from Group 3 to Group 11 of the periodic table,

m is an integer of 1 to 5,

Q is a nitrogen atom or a carbon atom having a substituent R^2,

A is an oxygen atom, a sulfur atom, a selenium atom or a nitrogen atom having a substituent R^5,

R^1 is an aromatic hydrocarbon group, an aliphatic hydrocarbon group or an alicyclic hydrocarbon group, selected from a phenyl group having, at least one position of the 2-position and the 6-position, when the position of the carbon atom bonded to nitrogen is the 1-position, one or more substituents

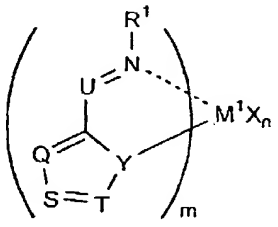
selected from a halogen atom and a halogen-containing group, or a phenyl group having, at least one position of the 3-position, the 4-position and the 5-position, and least one substituent selected from a fluorine-containing group having one carbon atom and not more than two fluorine atoms, a fluorine-containing group having two or more carbon atoms, a chlorine atom, a bromine atom, an iodine atom, a chlorine-containing group, a bromine-containing group and an iodine-containing group, an aromatic hydrocarbon group other than a phenyl group having at least one substituent selected from a halogen atom and a halogen-containing group, an aliphatic hydrocarbon group having at least one substituent selected from a halogen atom and a halogen-containing group, or an alicyclic hydrocarbon group having at least one substituent selected from a halogen atom and a halogen-containing group,

R^2 to R^5 may be the same or different and are each a hydrogen atom, a halogen atom, a hydrocarbon group, a hydrocarbon-substituted silyl group, an oxygen-containing group, a nitrogen-containing group, a sulfur-containing group, a boron-containing group, an aluminum-containing group, a phosphorus-containing group, a halogen-containing group, a heterocyclic compound residue, a silicon-containing group, a germanium-containing group, or a tin-containing group, two or more of R^2 to R^5 may be bonded to form a ring, and when m is 2 or greater, R^1s, R^2s, R^3s, R^4s, and R^5s may be the same or different, and one group of R^2 to R^5 contained in one ligand and one group of R^2 to R^5 contained in other ligands may be bonded,

n is a number satisfying a valence of M^1, and

X is an oxygen atom, a hydrogen atom, a halogen atom, a hydrocarbon group, an oxygen-containing group, a sulfur-containing group, a nitrogen-containing group, a boron-containing group, an aluminum-containing group, a phosphorus-containing group, a halogen-containing group, a heterocyclic compound residue, a silicon-containing group, a germanium-containing group or a tin-containing group, and when n is 2 or greater, plural groups indicated by X may be the same or different, and plural groups indicated by X may be bonded to form a ring;

a transition metal compound which is represented by the following formula (II-b)



(II-b)

wherein M^1 is a transition metal atom selected from Group 3 to Group 11 of the periodic table,

m is an integer of 1 to 5,

Y is a nitrogen atom or a phosphorus atom,

U is a carbon atom having a substituent R^6, a nitrogen atom or a phosphorus atom,

Q is a carbon atom having a substituent R^7, a nitrogen atom

or a phosphorus atom,

S is a carbon atom having a substituent R^8, a nitrogen atom or a phosphorus atom,

T is a carbon atom having a substituent R^9, a nitrogen atom or a phosphorous atom,

R^1 is an aromatic hydrocarbon group, an aliphatic hydrocarbon group or an alicyclic hydrocarbon group, selected from a phenyl group having, at least one position of the 2-position and the 6-position, when the position of the carbon atom bonded to nitrogen is the 1-position, one or more substituents selected from a halogen atom and a halogen-containing group, or a phenyl group having, at least one position of the 3-position, the 4-position and the 5-position, at least one substituent selected from a fluorine-containing group having one carbon atom and not more than two fluorine atoms, a fluorine-containing group having two or more carbon atoms, a chlorine atom, a bromine atom, an iodine atom, a chlorine-containing group, a bromine-containing group and an iodine-containing group, an aromatic hydrocarbon group other than a phenyl group having at least one substituent selected from a halogen atom and a halogen-containing group, an aliphatic hydrocarbon group having at least one substituent selected from a halogen atom and a halogen-containing group, or an alicyclic hydrocarbon group having at least one substituent selected from a halogen atom and a halogen-containing group,

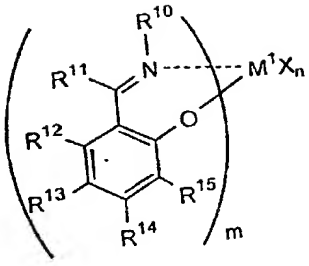
R^6 to R^9 may be the same or different and are each a hydrogen atom, a halogen atom, a hydrocarbon group, a

hydrocarbon-substituted silyl group, an oxygen-containing group, a nitrogen-containing group, a sulfur-containing group, a boron-containing group, an aluminum-containing group, a phosphorus-containing group, a halogen-containing group, a heterocyclic compound residue, a silicon-containing group, a germanium-containing group or a tin-containing group, two or more of R^6 to R^9 may be bonded to form a ring, and when m is 2 or greater, R^1s, R^6s, R^7, R^8s and R^9s may be the same or different, and one group of R^6 to R^9 contained in one ligand and one group of R^6 to R^9 contained in other ligands may be bonded,

n is a number satisfying a valence of M^1, and

X is an oxygen atom a hydrogen atom, a halogen atom, a hydrocarbon group, an oxygen-containing group, a sulfur-containing group, a nitrogen-containing group, a boron-containing group, an aluminum-containing group, a phosphorus-containing group, a halogen-containing group, a heterocyclic compound residue, a silicon-containing group, a germanium-containing group or a tin-containing group, and when n is 2 or greater, plural groups indicated by X may be the same or different, and plural groups indicated by X may be bonded to form a ring; and

a transition metal compound which is represented by the following formula (III)



(III)

wherein M^1 is a transition metal atom selected from Group 4 to Group 5 of the periodic table,

m is 1 or 2,

R^{10} is an aromatic hydrocarbon group, an aliphatic hydrocarbon group or an alicyclic hydrocarbon group, when R^{10} is a phenyl group and the position of the carbon atom bonded to nitrogen is the 1-position, this phenyl group has, at least one position of the 2-position and the 6-position, one or more substituents selected from a heteroatom and a heteroatom-containing group, or has, at least one position of the 3-position, the 4-position and the 5-position, at least one substituent selected from a heteroatom other than a fluorine atom, a fluorine-containing group having one carbon atom and not more than two fluorine atoms, a fluorine-containing group having two or more carbon atoms, and a group containing a heteroatom other than a fluorine atom, and when R^{10} is an aromatic hydrocarbon group other than a phenyl group, an aliphatic hydrocarbon group or an alicyclic group, this group has at least one substituent selected from a heteroatom and a heteroatom-containing group,

R^{11} to R^{14} may be the same or different and are each a hydrogen atom, a halogen atom, a halogen-containing group, a hydrocarbon group, a hydrocarbon-substituted silyl group, an

oxygen-containing group, a nitrogen-containing group or a sulfur-containing group,

R^{15} is a halogen atom, a halogen-containing group, a hydrocarbon group or a hydrocarbon-substituted silyl group,

n is a number satisfying a valence of M, and

X is an oxygen atom, a hydrogen atom, a halogen atom, a hydrocarbon group, an oxygen-containing group, a sulfur-containing group, a nitrogen-containing group, a boron-containing group, an aluminum-containing group, a phosphorus-containing group, a halogen-containing group, a heterocyclic compound residue, a silicon-containing group, a germanium-containing group or a tin-containing group, and when n is 2 or greater, plural groups indicated by X may be the same or different, and plural groups indicated by X may be bonded to form a ring.